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ORIGINAL ARTICLES

LUMBAR PUNCTURE AND EXAMINATION OF THE SPINAL FLUID.*

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In coming before you today for the purpose of presenting a paper, I desire to thank the gentlemen of the scientific committee for the honor bestowed upon me by extending to me an invitation to be present at this meeting of the Florida Medical Association. I am inclined to experience the same quakings that were felt by the meek and humble bat, who, in the course of his blind and aimless gropings, suddenly found himself in the majestic presence of a rookery of eagles. My timidity, however, is more than minimized by the opportunity afforded me, in being permitted to mingle with and exchange ideas with those now present, the distinguished physicians who compose the membership of this organization.

I will take the liberty to invite your attention at this time to a discussion of the question of the performance of the operation of rachiocentisis and the study of the spinal fluid. Interest in organic diseases of the brain and spinal cord is now more intense than ever before, due in part to the fact that insanity is no longer looked upon in the light of being a disgrace, but as a true disease entity, and further, through the epoch-making discoveries in the way of newly devised laboratory techniques, we are often enabled to diagnose, in general practice, early organic disease of the brain and cord, through the medium of examination of the spinal fluid.

*Read before the forty-third annual meeting of the Florida Medical Association at Arcadia, May 10-12, 1916.

I wish to say in the outset that I lay no claim to originality for the ideas advanced in this article, nor do I assume to a superior knowledge of the subject. I have quoted freely from numerous textbooks, monographs and other sources of information. By virtue of having had a rather extensive personal experience among patients with diseases of the mind and nervous system, it may be that I can suggest some ideas that will at least be a means of precipitating a discussion among you of benefit to the essayist and which may be a means of stimulating more interest in the early diagnosis of mental and nervous diseases, the victims of which unfortunate conditions constitute a class, more to be pitied than any other class of diseased humans.

In the stress of general practice I am inclined to the belief that the matter of making a thorough study of the spinal fluid is often lost sight of and to a more or less degree forgotten and because of the comparative infrequency with which the general practitioner encounters cases that really demand the operation of lumbar puncture, there is probably a tendency to relapse into the rut of not doing the operation except in rare instances.

Kaplan states that the credit for first withdrawing cerebrospinal fluid, properly, by right of priority, belongs to an American physician, Dr. J. D. Corning, who performed lumbar puncture in 1885. Essex Witner later conceived the idea of diminishing intracranial pressure by performing ventricular puncture. Cotungo, as early as 1769, studied the nature of spinal fluid in animals and men. Later, in a patient in whom the fontanels had prematurely closed, and in whom it was desired to reduce pressure, lumbar puncture had to be resorted to for

the purpose of withdrawing cerebrospinal fluid. This was done in 1889, and although the technique was crude, it served as a stimulus to other workers who further elaborated the study of the spinal fluid. The first paper by Quincke on the Technique of Lumbar Puncture and the Study of Cerebrospinal Fluid appeared in 1891. The thoroughness with which the subject was treated, and the painstaking efforts of the distinguished German investigator, justify the coupling of his name with the operation of lumbar puncture and, in fact, with the entire subject of research work done on the cerebrospinal fluid.

The spinal fluid occupies the space between the pia and the arachnoid, the so-called subarachnoid space. It comes in contact with the periphery of the brain and cord and probably communicates with the ventricles. Cerebrospinal fluid can be demonstrated as early as the fourth month of fetal life and at a time when the pacchionian bodies are absent. The theory has been advanced that the pacchionian bodies act as a filtration agent for the spinal fluid, and that, therefore, the elimination of carbon dioxide is augmented and carried out. This theory is as yet unproved and is of no practical importance. It has also been held that the pacchionian bodies play an important role in the formation of cerebrospinal fluid. The fact that the fluid is demonstrable before the pacchionian bodies are formed would seem to disprove this.

It has been said by Mott that the fluid is probably a secretion of the choroid plexus of cells, which statement is probably true. It is improbable that an opening between the ventricles and subarachnoid space exists. In patients with icterus the spinal fluid is stained yellow, whereas the fluid in the ventricles remains unstained. It is a popularly accepted theory that because spinal fluid presents an appearance of hemorrhagic discoloration in cases of rupture of the ventricles that a natural opening exists between the ventricles and the subarachnoid space. This is probably an erroneous view as the trauma necessary to produce rupture of a cerebral ventricle would in all probability be of sufficient violence to break down any natural barrier that may exist between the subarachnoid space and the ventricular cavities. This idea in itself seems to be rather faulty because of the fact that small particles of dyestuff injected into the spinal canal will find their way into the ventricular fluid. The phenomenon would appear to disprove the theory that the pacchionian bodies act as a filtration medium. It has been demonstrated within the last year by experimental work on dogs that liquids colored with aniline dyes may be injected into the spinal canal with sufficient force to cause the colored spinal fluid to find its way through the cribiform plate of the ethmoid and escape from the nostrils of the animal; and, as an interesting observation, this extreme pressure was without serious results for the animal.

The subarachnoid space is traversed by fine connective tissue trabeculæ, of which little is known although they assume a pathological role when they become thickened. The chief function of the cerebrospinal fluid is that of a protective agent in that it acts as a cushion and prevents a jarring of the substances surrounded by it. The cerebrospinal fluid also tends to neutralize substances that are considered as excretory, forming inert combinations of complex organic constitution. Mott in a personal communication to Kaplan suggests that the presence of glucose in the spinal fluid appears to furnish an energy supply to the nervous apparatus.

It is desirous to obtain specimens of the spinal fluid for the purpose of assisting in establishing diagnoses and for the purpose of carrying out different therapeutic procedures.

In many of the obscure meningeal inflammatory conditions encountered in children an accurate diagnosis can hardly be made without an examination of the spinal fluid.

Many of the cases of insanity that one encounters are difficult of diagnosis, with any degree of certainty, without lumbar puncture. Among the psychoses and nervous diseases may be mentioned general paresis and locomotor ataxia. In these two conditions the presence of an increase in cell count is highly significant and often it has been observed that the cerebrospinal fluid gives a positive Wassermann reaction in cases where serum from the general blood circulation shows a negative Wassermann. Tubercular meningitis, meningococcic meningitis, and in fact any of the bacillary infectious conditions found in the spinal fluid are of necessity obscure and indefinite without a careful examination of the cerebrospinal secretion. In cases of increased intracranial pressure, the mere withdrawal of the fluid is rewarded with a surprising amount of improvement in the patient. Flexner's serum, in cases of cerebrospinal meningitis, when injected into the spinal canal early, has reduced the mortality rate of this disease from 90 per cent to the surprisingly low rate of 10 per cent. The use of a solution of magnesium sulphate injected intraspinously in cases of tetanus has worked happily in many instances. Antitetanic serum injected into the muscle, given intravenously and intraspinously, often effects a prompt recovery in cases that would have been regarded as fatal ones under former plans of treatment.

Comparatively recently, in cases of paresis, locomotor ataxia and cerebrospinal syphilis, it has been the plan to subject the patient to a series of intravenous injections of salvarsan, and after a few such injections have been given, the blood is drawn off, twenty minutes after an intravenous injection of salvarsan, in sufficient quantity to produce from 15 to 30 cubic centimeters of serum, which is not only a salvarsanized serum but, probably on account of its recent contact with spirochetes, contains real antibodies and is consequently possessed of antitoxic properties. This serum is injected with equal parts of normal saline solution or without dilution with saline solution, into the spinal canal, the same amount or a greater amount of spinal fluid having been previously withdrawn than that of the quantity of serum to be injected. At the meeting of the American Medico-Psychological Association at Old Point Comfort, Virginia, and at the meeting of Alienists and Neurologists in Chicago during the past year the question of treating syphilitic diseases of the nervous system by this so-called Swift-Ellis technique was thoroughly discussed by men of unquestioned ability, and while there was a tendency toward extreme conservatism, the fact that numerous cases of paresis had been discharged and had been out of institutions for periods of as long as two years, and while slightly demented still able to earn a living and occupy their former position in the business world, would seem to add an element of optimism to the discussion of the subject. In our own experience at Chattahoochee we have been dubious to an extreme degree of the wiseness of this plan of treatment so far as effecting cures and mental restorations in cases of paresis and other metasyphilitic conditions of the central nervous system are concerned. The theory is a brilliant one to say the least, but because of the fact that arsenic is demonstrable in the spinal fluid soon after a patient has been given an intravenous injection of 606, and because of the fact that the spirochetes are imbedded in the brain substances in localities that are far removed from the active blood circulation, because of the further fact that all the evidences at hand would seem to indicate that the circulation is not from without inward in the brain, but from within outward, and because of the fact that blood stained with aniline dyes and injected into the spinal canal, and even into the cranium, scarcely finds its way to any extent over the brain surface even, and in no instance penetrates the brain substance, it would appear that even assuming that 606 is a specific for syphilis, there is absolutely

no assurance, by any means at hand, that the drug is coming in contact with the organisms of syphilis imbedded in the brain, no matter how the drug may be administered. The only ray of hope to be offered in a condition of this kind is the obscure one which rests upon the possibility of the antitoxic property of salvarsanized blood serum being absorbed in some way as yet unknown to the medical profession. Intraventricular injection of neosalvarsan dissolved in the patient's blood serum is a recent new plan of treatment in paresis. This seems to give promise of favorable results. It may be stated that the neurologic and psychiatric world has for sometime been investigating, and is yet working courageously on the problem. A roseate deepening flushes in the East which we trust presages a day in which paresis and locomotor ataxia will become amenable to physicians' treatment.

The weight of opinion from our most eminent men in the psychiatric world is that paresis and locomotor ataxia are in every instance caused by syphilis, but that they are not active manifestations of the disease. A valuable point in considering the gravity of a mental case that is known to have in the past contracted syphilis, is to bear in mind that no case of paresis has ever been known, so far as we are able to determine, to develop under a time minimum of two years, and it may be said that the vast majority have not developed paresis or locomotor ataxia until five or more years time have elapsed from the date of acquiring the initial lesion of syphilis. On the other hand it is a matter of common knowledge to us all that tertiary lesions of syphilis develop frequently within a year's time from the appearance of the initial lesion.

Before attempting the operation of lumbar puncture it is advisable to consider some of the complications and contraindications of the procedure. In cases of tumors of the posterior fossæ of the cerebellum, wherein the necessity for examining the fluid for the definite establishment of a diagnosis of syphilis seems urgent and necessary, it is permissable to remove one or two cubic centimeters of the fluid, replacing same with an equal amount of sterile normal saline solution and then placing the patient in bed with the feet elevated for at least four hours. In cases of extreme physical debility it is advised not to perform lumbar puncture. There have been quite a few deaths following the procedure and complications such as paraplegia as the result of puncturing a vein have occurred, but I may say that in an experience of several years, doing the operation as a routine procedure, and seeing it done by my colleagues time and time again, I have never seen any unfavorable results other than headache which disappears rapidly upon rest in bed, liquid diet, a purgative, and occasionally a small dose of morphine. In doing the operation of lumbar puncture I am convinced that the procedure is not free from danger, especially when performed with the patient in the sitting position. It has been shown that, in cases of brain tumor particularly, the sudden withdrawal of spinal fluid is inclined to produce a condition of prolapse of the cerebral structures into the foramen magnum with consequent pressure on the blood vessels and danger of syncope from cardiac or respiratory failure. It is my practice to have the patient in the recumbent position on his side with the body arched forward at both extremities and the spinal column consequently in a position of extreme flexion. A needle with stylet in place is introduced on an imaginary line between the crests of the iliac bones at the junction at the third or fourth lumbar vertebræ. In the adult the spinous processes are more acutely depressed and less in the horizontal plane than they are in the child, therefore, in the adult the needle is usually introduced a little to one side of the median line, and introduced in a slightly upward direction. In the child the needle should be introduced directly in the horizontal plane. In performing the operation for the first time it requires considerable

self-confidence by virtue of the fact that it is necessary to introduce the needle for a distance of from 2½ to 3 inches. The tough ligamentum subflavum requires considerable introducing force and the needle should be held between the thumb and index finger rather close to the skin at all times. Haste should be avoided as sudden impact with the bony structures may cause breakage of the needle. The entrance of the needle into the spinal canal is usually indicated by a sudden diminution in the amount of resistance. The specimen of spinal fluid may be tinged with blood. This may indicate a previously occurred meningeal hemorrhage or it may be that a small blood vessel has been broken in the introduction of the needle. The spinal fluid in cases of meningeal hemorrhage is less red in color than that observed in a condition of very recent hemorrhage. Occasionally we encounter a dry tap and in the past operators have been subjected to some unwarranted criticism when announcing that they had encountered a condition of dry tap, but it has been demonstrated in these cases that by introducing a needle into the next interspace above and injecting normal salt solution, that this salt solution would run from the lower needle, thus establishing beyond question that a dry tap is entirely possible. The patient can assist in the process of introducing the needle by taking a long breath. It is entirely possible that the spinal fluid is not in a state of stagnation. It probably has a definite route and direction of flow. The bilateral ligamentum denticulatum, the septum posticum of Magendie, and the aeriolar trabucalæ may act as valves and control the flow of the spinal fluid in one direction. The fluid is probably forced into the sub-arachnoid space, and again into the anterior chamber of the spinal column by the variation in pressure, and resistance brought about by the filling and emptying of the veins in the dura mater, the act of inspiration and respiration, and the diastolic and systolic action of the heart.

Of course, it is needless to say that the operation of lumbar puncture should be done under strict aseptic precaution and, as previously stated, in the recumbent position. In each instance it is advisable to have at hand a hypodermic syringe with ether for use in case of threatened collapse. This is preferable to strychnine owing to its locally irritative and reflex stimulative effect.

The specific gravity of spinal fluid ranges from 1.003 to 1.009. It is absolutely tasteless and odorless. In pathological states even the color of the fluid may be unchanged, and, in fact, in the majority of diseases of the nervous system, the fluid is not different in appearance from that of a normal fluid. I had the opportunity of examining specimens of spinal fluid from a case of epidemic cerebrospinal meningitis, which was of a greenish, turbid consistency and color. Later on the cord, ventricles and outer surface of the brain were found to be bathed in pus. Normal fluid has no ability to form a clot. In diseased conditions a tendency toward clot formation and the characteristics of the clot in the individual case may be an index as to the probable nature of the process. In cerebrospinal meningitis a clot-like mass may form with a cobweb appearance diffused throughout the liquid. In tubercular meningitis there is a tendency toward clot formation, which is centrally placed in the liquid with radiating fibrin filaments. In acute poliomyelitis there is no tendency toward clot formation.

The reaction of normal spinal fluid is slightly alkaline and is just in excess of one per cent of solid matter. On account of the alleged presence of glucose spinal fluid is capable of reducing Fehling's solution. The protein matter that is found in specimens of spinal fluid is globulin and albumose. Cholin, due to decomposition of cerebral spinal nerve matter, lecithen, lactic acid, phosphorous and the potassium salts that are also found are not so significant as the protein content. This protein matter is of great importance. There are numerous methods, but that of

Kaplan is of such simplicity as to appeal to the everyday observer. Into a test tube 1 cm. wide and 8 cm. long, is placed 5 cubic centimeters of the spinal fluid to be analyzed. It is heated until it boils up twice, then three drops of 5 per cent solution of butyric acid in normal salt solution are added, followed immediately by 5 cubic centimeters of a super-saturated ammonium sulphate solution and set aside for twenty minutes. Care must be taken not to mix the ammonium sulphate solution with the test tube contents. In twenty minutes the excess of globulin manifests itself by the formation of a thick, granular, cheese-like ring. When no ring forms the globulin content may be regarded as normal. For general purposes it may be said that with a significant cell count and the presence of a globulin ring, the presence of syphilitic disease of the central nervous system is to be strongly suspicioned, this presence to be further verified by the Wassermann test.

Dr. B. Lemchen of the Chicago State Hospital has devised a new test for the presence of globulin in the spinal fluid. Experimenting with tests for determining the presence of that substance he takes 5 cubic centimeters of spinal fluid, to which he adds an equal amount of 30 per cent normal sodium hydroxide, mixing the two fluids well together, and then adding a layer of an equal amount of picric acid, in water, so that the picric acid comes in contact with the fluid only. In the presence of globulin a white floculent precipitate appears a little above the point of contact. With this test it is claimed that in the absence of a precipitate no organic brain disease exists.

There are numerous cells encountered in a cytological study of the spinal fluid. In general, it may be said that in tubercular diseases of the brain and cord the lymphocytes are in excess. In cerebrospinal meningitis we, as a rule, encounter an excess in the polymorphonuclears. In acute poliomyelitis there is usually an excess in lymphocytes. In the latter two conditions, however, the leucocyte picture may vary but a bacteriological examination will usually clear up the situation. In general, it may be stated that in the event polymorphonuclears are in excess, there is an acute condition to deal with, and in the presence of an excess of lymphocytes there is a chronic condition to deal with. Cell counting is a procedure not to be neglected in an examination of the spinal fluid. We find normally from four to eight cells, generally lymphocytes, in each cubic centimeter of spinal fluid. In our work we use the Fuchs-Rosenthal method of cell counting. The difference between the Fuchs-Rosenthal counting chamber as compared with the ordinary hameocytometer chamber is that in the Fuchs-Rosenthal chamber we have an area 16 mm. square and 2-10 mm. deep, resulting in a count in an area of 16-5 mm. In the ordinary chamber we have an area 1 mm. square and 1-10 mm. deep resulting in a cell count in an area of only 1-10 of a square mm. The solution used in the Fuchs-Rosenthal method is methyl violet, 1 gm. glacial acetic acid, 2 gm. water q. s. 500 cubic centimeters. This fluid should be prepared from time to time and a few drops of chloroform added to prevent pennicilium formation, but even with this precaution the fluid will not keep well and should, therefore, be made in only one or two dram quantities. The staining fluid should be drawn into the capillary tube to the point one and the spinal fluid to the mark 11, giving a dilution of ten to one. A drop is then placed in the well of the counting chamber and cover slip applied. Count the cells in 256 of the small squares, multiply this by 11, and divide by 32, and this will give the number of cells per cubic centimeter. Any decided increase of cells over ten or fifteen per cubic centimeter should cause grave suspicion of the existence of organic brain disease.

Another method has been advanced which is probably more simple, and consists of placing equal parts of glacial acetic acid and

hydrogen peroxide in a test tube and adding thereto about as much benzidin as can be carried on the point of the blade of a pen knife. The solution is used in exactly the same manner as the Fuchs-Rosenthal solution, and with its use not only may white blood cells be identified but a fairly accurate differential count may be made. The red cells have a bluish appearance, the polymorphonuclear a yellowish appearance. The lymphocytes have a yellow nucleus with a blue ring surrounding. Plasma cells have a yellowish net work with blue granules.

It is important in withdrawing spinal fluid to guard against accident, and I can not impress you too strongly with the idea that dangers do exist in this operation, and that the only known means to guard against accidents is to carefully observe the patient's blood pressure with a reliable blood pressure apparatus during every moment of the operation. Should the blood pressure fall to any great extent suddenly, withdrawal of the spinal fluid should be immediately stopped and a liberal amount of normal salt solution introduced into the spinal canal and a hypodermic of ether administered immediately. It is, of course, important to observe the pressure of spinal fluid as any increase in pressure generally indicates a diseased condition in the brain, but absence of pressure in the spinal fluid does not absolutely rule out the existence of intracranial pressure, because in certain brain tumors, on account of prolapse of the cerebral structures in the foramen magnum, a condition of mechanical stoppage exists there which fails to give an increased pressure in the spinal canal. For everyday use it may be said that so long as the fluid flows in drops the pressure is normal, and if in a continuous stream it is abnormal. A simple means of accurately determining spinal fluid pressure is to use a glass tube marked in mm., and connected by a short rubber tube to the spinal puncture needle. This will give a spinal fluid pressure based upon water pressure and generally averages from 80 to 150 mm. Abnormal pressure may range from 200 to 800 mm., water pressure.

The bacteria present in the spinal fluid are the diplococcus of cerebrospinal meningitis, the pneumococcus and the tubercle bacilli. Of course, in cases of fracture of the skull we may find an accidental infection by any organism. In contrast to tubercular pleurisy, wherein tubercle bacilli are seldom if ever found, we find the organism in from 50 to 75 per cent of all cases of tubercular meningitis. Owing to the fact that there is practically no organic content in spinal fluid, it is rather difficult to precipitate organisms even with a bacterial centrifuge. A valuable point in this connection is the practice of adding equal parts of alcohol to the specimen of fluid to be centrifuged. This procedure contains both a precipitate of the protein content of the spinal fluid, and the precipitation naturally tends to mechanically carry with it any germ life that may be present. The staining methods are, of course, the same as in any other examination for tubercle bacilli. The presence of tubercle bacilli in such a large majority of cases of tubercular disease of the brain and cord and the frequent finding of milliary tubercules, post mortem, in the membranes of the brain and cord, leads to the assumption of primary tubercular diseases here.

Lange's colloidal gold test, a color reaction, simple in application and almost as reliable an instrument of precision as the Wassermann test is a procedure not to be omitted in the examination of spinal fluid, but owing to the elaborate paraphernalia and extensive practice necessary to successfully prepare the test solutions of gold, the technique can not well be carried out by the individual investigator in private practice. This, of course, applies to the Wassermann tests and therefore in cases of doubtful history or even in the face of negative findings our diagnosis can not be well established without a report from specimens submitted to a reliable serologist.

I trust that this discussion has not been

too long and tedious and too much of a tax upon your patience or a reflection upon your intelligence. The fact of working as we do in an isolated position among a population of 1,500 or more insane wards of the State of Florida and constantly encountering conditions of diseases in the brain and cord, possibly makes us more inclined toward enthusiasm for such matters than we would be under different surroundings.

THE INTERPRETATION OF THE WASSERMANN REACTION.*

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In the examination of sera from suspected and treated cases of syphilis upon which we have based our study for the preparation of this paper, we have used cholesterinized antigens prepared from extracts of human heart tissues together with acetone insoluble beef heart preparations. In the examination of two hundred and fifty sera from approximately two hundred patients, in no instance has the deviation of complement varied to any extent with the preparation of antigen employed.

In common with other investigators, we have determined that a large number of undoubted cases of primary syphilis give negative Wassermanns. A review of the literature discloses a wide variation in the percentage of negative reactions in positive clinical cases as determined by various investigators. Thus, in England, Bassett-Smith reports 76 per cent positive in 183 cases; in this country Noguchi and Kaplan 90 per cent positive in 208 cases; in Germany, Hoehne but 28 per cent positive in an unstated number of cases, and in Sweden, Boas 73 per cent positive in 76 cases, and Markus 75 per cent positive in 120 cases. Primary cases within the first week or ten days usually give negative reactions. In secondary cases we do not find quite as wide a variation in the percentage of positive reactions found by various investigators. Thus of the six authors just cited, Bassett-Smith reports 94 per cent positive in 407 cases, Noguchi and Kaplan report 90 per cent in 478 cases, Hoehne 79 per cent in an unstated number of cases, Markus 91 per cent in 250 cases and Boas 90 per cent in 2,754 cases.

We would especially emphasize the fact that a positive Wassermann reaction should be taken as prima facie evidence of syphilitic infection of either congenital or acquired origin, bearing in mind, however, that positive Wassermanns have been secured in leprosy, yaws, in the febrile stage of malarial infections and in psoriasis. On the other hand, many cases of undoubted syphilis will at various times during the disease give negative reactions. This is especially true of cases under treatment.

The following cases of clinical secondary lues giving negative Wassermanns, the diagnosis later being confirmed by positive reactions, are of interest:

Case I. J. L. Mc., male, single, age 28, a salesman, referred by Dr. Van Landingham of Ft. Pierce, February 15, 1915. Denies venereal history. Presents a typical syphilitic alopecia. Peridental ulceration around second lower molar. No other symptoms. Wassermann and Noguchi tests negative. He was given a local application for the scalp and three grains of sodium cacodylate hypodermically three times a week for four weeks. April 2nd, Wassermann 3 plus positive. On April 12th he was given .6 gm. salvarsan intravenously, a week later .9 gm. neosalvarsan, and on April 24th was put on protoiodide of mercury for six weeks, July 5th, ten weeks later, he still gave a 3 plus Wassermann. He was continued on protoiodide of mercury for periods of six weeks with two-week intervals until December 25th. On February 2, 1916, Wassermann negative.

Case II. J. R., male, married, age 26,

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referred by Dr. D. F. Smith of Gainesville, March 1, 1913. Denies venereal history. Presents an iritis of two weeks duration. No other symptoms. Wassermann negative. Local treatment for three weeks with but little improvement. March 22, 1913, provocative Wassermann (.2 gm. salvarsan) 3 plus positive. Decided improvement followed and a full dose .6 gm. salvarsan was administered on April 10th followed by mercurial inunctions for two periods of three weeks each, with an interval of three weeks. On July 2nd he was placed on protoiodide of mercury for four six-week periods with two-week intervals. June 1, 1915, he returned with rheumatic pains and general syphilitic toxic symptoms. Wassermann 4 plus positive.

The value of the Wassermann reaction as a routine procedure in all cases presenting difficulty in diagnosis has been attested by many authors. The following cases coming under our observation having no objective symptoms of syphilis but giving positive Wassermanns, exemplify the advisability of such routine examinations:

Case III. B. G. B., single, age 24, referred by Dr. C. P. Rogers of Jacksonville, February 2, 1911. History of chancre three years previous. No objective symptoms. Wassermann 4 plus positive. Salvarsan .6 gm. was given intravenously on March 2nd, and repeated April 1st. Ten days later he was given salicylate of mercury intravenously three times a week for three periods of six weeks with two-week intervals. On October 2nd, a negative Wassermann was secured—a similar reaction on June 4, 1912, and again as late as March 21, 1915.

Case IV. R. H. C., single, age 31 (candidate for marriage) referred by Dr. Roy Chalker of Lake City. The patient gave a history of a slight sore on the penis eighteen months previous. No objective symptoms other than a general adenopathy. Wassermann reaction 4 plus positive. He was given .6 gm. salvarsan intravenously every two weeks until three injections had been administered, followed by two three-week periods of mercurial inunctions; mercurial stomatitis produced during each period. On January 1, 1913, the serum gave a 2 plus positive Wassermann. On January 20th another injection of .6 gm. salvarsan was given, followed by a six-week period of intramuscular injections of salicylate of mercury. From May 1, 1913, to December 1, 1913, protoiodide of mercury was administered by mouth for periods of six weeks with two-week intervals. On February 1, 1914, a negative Wassermann was secured, again during the following September and in August, 1915.

The value of the Wassermann reaction as a diagnostic aid has for some years been recognized by all clinicians. It is, however, of especial value in checking up the effect of treatment. Even before the days of salvarsan many active cases of lues apparently got well under treatment, and since the introduction of this therapeutic agent, the changes in both subjective and objective symptoms of active cases is often marvelous. In spite, however, of the marked improvement these cases undergo and their belief that they are completely cured, we find many such that even following the most intensive and insistent treatment both with salvarsan and mercury, still give positive Wassermann reactions, thereby showing the danger of discontinuing treatment. That many cases can not be reduced to negative reactions, we have no doubt. The following cases are illustrative of this type of infection:

Case V. L. B., dairyman, age 26, presented himself May 20, 1913, suffering with a secondary lues. He was at once given .6 gm. salvarsan intravenously, the same dose being administered ten days later, and again after a period of fifteen days. With a few days' rest he was placed on intramuscular injections of salicylate of mercury three times a week for periods of six weeks each, with two-week intervals. On June 4, 1914, he gave a 2 plus positive. On October 10, 1914, he was given .9 gm. neosalvarsan intravenously followed by three weeks of inunc-

tion of mercury to the point of salivation. The patient was lost to observation until January 13th of the present year, when he presented himself with syphilitic ulcers on the tongue and tonsils, with a perforating ulcer of the soft palate, and a papular eruption which was general. His serum at this time still gave a 4 plus positive Wassermann.

Case VI. J. W. T., age 32, single, presented himself for diagnosis July 1, 1912, giving a history of syphilis two years previous. No objective symptoms. Wassermann 2 plus positive. He was given two doses of .6 gm. salvarsan intravenously at thirty-day intervals, followed by three six-week periods of protoiodide of mercury pills by mouth, and one three-week period of mercurial inunctions. March 2, 1914, his serum still gave a 2 plus positive. On March 5, 1915, he underwent a nephrectomy for tuberculosis of the left kidney. On August 10th his serum remained uninfluenced, still giving a 2 plus positive.

Case VII. W. H. L., police officer, age 23, single, presented himself with a primary sore and mixed infection, later followed by typical secondaries. He gave a history of mercurial idiosyncrasy, stating that one grain of calomel had produced marked ptyalism. On two separate occasions during the course of treatment this was proven by such a marked reaction after taking one grain of salicylate of mercury intramuscularly that he had to consult a dentist on both occasions. From April 12, 1914, to June 6, 1915, a period of fourteen months, he was given two .6 gm. salvarsan and six .9 gm. neosalvarsan intravenous injections. On August 3, 1914, Wassermann was a 2 plus positive. From September 6th to December 1st he was given cacodylate of sodium in 3-grain doses three times a week. On January 10, 1915, he gave a 4 plus positive Wassermann.

It is not unusual for treated cases of syphilis giving negative reactions, after a lapse of time with or without treatment, to again become positive. It is therefore not a safe procedure to discharge a treated case of syphilis giving a negative Wassermann until several negative reactions have been secured over a period of some considerable time. We have deemed it wise to test sera of all apparently cured cases three months after all treatment has been withdrawn, to repeat the test three months later, again in six months and to submit sera to a final examination eighteen months after the first negative reaction is secured. In the event that a positive reaction is secured at any time during this interim, treatment, the type depending upon the circumstances in the case, is again instituted and the routine examination of the serum is again taken up. The following cases are typical examples of treated cases giving negative reactions, later becoming positive, demonstrating the cure incomplete. Upon being given further treatment a series of negative reactions was secured and the patients discharged cured:

Case VIII. R. H., single, clerk, age 27, came under observation September 7, 1914, with primary and secondary lesions of six weeks duration. The following day he was given .6 gm. salvarsan intravenously, the dose repeated ten days later and on the 28th he received .9 gm. neosalvarsan. This was followed by four six-week periods of salicylate of mercury intramuscularly with a few days intervals of rest. On May 2, 1915, he gave a negative Wassermann. The following August he had recurrence of mucous patches, his serum giving a 2 plus Wassermann. .9 gm. neosalvarsan was administered intravenously at once, followed by mercurial inunctions for three weeks. Commencing September 1, 1915, and continuing for six weeks he was given 5 grs. of cacodylate of sodium three times weekly. On January 3rd of this year he gave a negative Wassermann.

Case IX. R. S., age 26, single, presented himself December 3, 1914, giving a history of simple abrasion near corona glandis six

weeks previous, a diagnosis having been given of "hair-cut," and treatment administered consisting of antiseptic powders, the lesion disappearing in a few days, leaving a small elevation. Upon examination, he presented a scattered papular eruption over the chest, arms and thighs, an inguinal adenitis and several small ulcers of the oral mucosa. No subjective symptoms. The serum gave a 4 plus Wassermann. He was given .4 gm. salvarsan at once, .6 gm. a week later, .9 gm. neosalvarsan in ten days, and on January 4, 1915, .6 gm. neosalvarsan. On January 15th he was placed on salicylate of mercury intramuscularly, continuing for three periods of six weeks each with two weeks intervals between periods. On July 1st he gave a negative Wassermann, on September 2nd his serum returning to a 2 plus positive. Upon being placed on cacodylate of sodium, receiving three grains every other day for six weeks, his serum became negative on November 11th. A similar reaction being secured on February 6th of this year.

Conclusions.

1. Positive Wassermann reactions should be taken as prima facie evidence of syphilitic infection.

2. Many cases of syphilis will, at various times during the course of the disease, give negative Wassermann reactions.

3. A Wassermann test should be conducted on all obscure cases as a routine procedure.

4. The Wassermann reaction is invaluable as an agent for determining the effect of treatment in syphilis.

5. Many cases of syphilis are incurable.

6. No case of syphilis should be discharged as cured until at least four negative Wassermann reactions have been secured, the last negative to be at least eighteen months after treatment has been discontinued.

THE DIAGNOSIS AND TREATMENT OF SYPHILIS.*

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Syphilis is primarily a disease of the blood vascular system, but the infecting organism, the spirochæta pallidum, may attack any tissue or organ of the body. In fact it plays an important role as an etiological factor in diseases of the nervous system, heart and aorta, liver, kidneys, lungs, stomach, eyes, ears, nose, bones, joints, muscle, pancreas, etc., and it may simulate almost any organic disease from ringworm and eczema to tumors, benign and malignant, typhoid, tuberculosis, malaria, etc.

In order to diagnose syphilis we have to keep it constantly in mind as one of the possibilities in the diagnosis which must be eliminated by evidence. Primary and secondary syphilis is easily diagnosed. The organism can be demonstrated in a large percentage of chancres, probably 95 per cent and possibly 100 per cent, providing no local treatment has been applied. The Wassermann is nearly always negative during the first week of the initial sore, but during the fourth week practically all cases give a positive reaction.

It is the later results of syphilis that I am particularly interested in in this paper and I shall illustrate by case histories the diagnosis and treatment of the disease.

The febrile type of syphilis is not infrequently looked upon as typhoid, tuberculosis or malaria. The most interesting case of this type I have seen was S. R., a mill foreman, age 42. He came in complaining of having had fever every day for eleven months. He stated that at one time it was thought that he had typhoid, and later he was diagnosed tuberculosis and malaria. He had his primary twenty years ago and was treated with one course of mercury at Hot

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Springs. On examination he had a temperature of 101.6 and a few ulcer scars on his shins. The physical examination was otherwise negative. The white blood count was normal and there were no malarial parasites found. Blood was taken for Wassermann and it was strongly positive. As a precaution I gave him 25 grains of quinine solution per day while I was waiting for Wassermann result. The quinine did not stop his fever, but mercury, iodides, and salvarsan did, and his general condition improved markedly.

Syphilis ranks fourth as an etiological factor in organic diseases of the heart and aorta. Myocarditis and aortitis with involvement of the aortic valves are the most common syphilitic lesions causing circulatory disturbances. The first indication of the disease of the heart may be a pericarditis, however, as in this case. A man, 56 years of age, came in complaining of pains over his heart and fever. He was the father of nine children, his wife had had two miscarriages and there was no history of syphilis. His examination was negative excepting that he had a beautiful systolic and diastolic friction rub over the precordium and a strongly positive Wassermann. After four injections of ¼ gr. doses of biniodid his friction rub disappeared and his temperature approached normal. He was given a course of 30 injections of biniodid, and potassium iodide by mouth. Later, he returned for a second course of mercury and at this time his Wassermann was again positive, and still later he was given salvarsan.

Frequently, in diagnosing syphilis of the heart, we have to observe the patient over a period of several months before we can get sufficient evidence to base the diagnosis on, as in the following case. M. L., age 52, laborer, came in with cardiac decompensation. There was no valvular lesion and his blood pressure was normal. The heart was markedly hypertrophied and dilated and there was nothing in his history to account for it excepting possibly manual labor. His Wassermann was negative. He was given, however, a course of mercury and iodides after his heart compensated, and he seemed to be improved and was discharged. Later, he came into the hospital again with decompensation, another Wassermann was done and this time it was strongly positive. His mercury treatment was continued and later examinations of his blood gave positive reactions. The treatment possibly had something to do with making the reaction become positive.

In syphilitic aortitis we may get a history suggesting disease of the aorta and we may not. The most common symptoms are pressure on the chest, paroxysmal dyspnea, paroxysmal tachycardia, and anginal pains in the chest and down the arms. The physical signs are the metallic second sound when the root of the aorta is involved, widening of the mediastium to percussion, evidence of elongation of the aorta by pulsation in the episternal notch and supra clavicular fossa, widening of aorta as shown by X-ray and finally a positive Wassermann.

A later stage of syphilitic aortitis is aneurysm and you are familiar with its signs and symptoms.

As an example of syphilitic aortitis with involvement of the aortic ring and valve, together with myocarditis, this case may be of interest, viz., a man aged 49, machinist, came in complaining of attacks of shortness of breath and excruciating pains in his heart and down his arms, but mainly the left, and he felt as if a heavy weight was on his chest. His examination was negative excepting for the following evidence: He was dyspnœic and had repeated attacks of anginal pain which were relieved with amyl nitrite, mediastinal dullness was increased, pulsation in the episternal notch and supraclavicular fossa, his heart was enlarged, blood pressure normal, the aortic second sound had a metallic ring, and there was a diastolic murmur along the left sternal border when he exerted himself, Wassermann was strongly

positive, X-ray photograph showed aorta dilated and elongated. He died in one of his anginal attacks. At autopsy the characteristic puckering up of the intima of the aorta was found and the coronaries showec an advanced grade of arteritis. The myocardium had an increase of fibrous tissue and round cell infiltration about the blood vessels — a syphilitic myocarditis with syphilitic aortitis.

Longcope reported a number of cases of syphilitic aortitis and his results show that the average length of life was less than two years in about 70 per cent of the cases. He treated his cases with salvarsan and iodides. Mercury and iodides in my experience give the better results in the treatment of syphilis where there are marked arterial changes and there are practically always changes in the arterial system in late syphilis. I shall bring this point out in the treatment of syphilis of the nervous system.

The central nervous system is affected in a large percentage of the cases of latent syphilis as well as in active syphilis. Now, how are we going to recognize early syphilis of the nervous system? The most common symptom of brain syphilis is headache or perhaps migraine and the condition is not usually investigated till some distressing symptoms arise. Dizziness is also a common symptom. The other symptoms may be insomnia, emotional disturbances as crying spells, deafness, disturbances of vision, mental disturbances, neurasthenia, weakness or paralysis of the cranial nerves, loss of smell and taste, epileptic convulsions, etc.

In syphilis of the cord the first symptom may be visceral crisis which may be mistaken for gastric ulcer, gall stones, etc. Other symptoms may be pains in the back and down the legs, paralysis of voluntary muscles, disturbances of sensation, disturbances of motion, ataxia, disturbances of the bladder and rectum and so on.

The only way we can diagnose syphilis of the nervous system is to investigate the symptoms and signs of disturbances of this system when we are given the cue by making a complete physical examination, by testing the functions of the various cranial nerves, including examination of the eye grounds, testing reflexes, motor power, sensation, etc. Another point in the examination of vital importance is the lumbar puncture and a pipette cell count of the spinal fluid and the Wassermann of the fluid and blood.

Now I want to report a few cases showing the problems of diagnosis:

Case I. A woman, age about 48, married, had been treated for two months in a hospital for gastric ulcer. Her main symptoms had been attacks of severe pain in the epigastrium and vomiting. One month after she was discharged she was admitted to Lakeside Hospital in a semi-comatose condition, markedly emaciated, vomited everything taken by mouth, and her color was dark yellow or brownish, pupils reacted sluggishly to light, blood pressure 85 systolic, she was weak and could scarcely turn over in bed. Abdomen was distended. An enema was given and was not retained, which suggests paralysis of the sphincter. She voided involuntarily. The deep reflexes were more active in the right leg than the left and there was a positive Babinski, indicating spinal cord changes. Now, what are our possibilities? The history of a diagnosis of gastric ulcer together with the vomiting, emaciation, anæmia and the spinal cord signs suggested that it might be a cancer on an ulcer base with metasteses to the nervous system. The brownish pigmentation, emaciation, low blood pressure, marked weakness and gastro-intestinal symptoms suggested Addison's disease with a tuberculous focus in the cord. The marked anæmia, spinal cord changes and gastro-intestinal symptoms suggested pernicious anæmia. Syphilis may, however, wear the crown. How was a definite conclusion reached upon evidence? A lumbar puncture was done and over two hundred lympho-

cytes per cmm. were found in the fluid. The Wassermann was strongly positive in both the blood and spinal fluid, and thus the diagnosis of cerebrospinal syphilis was made. She was given biniodid of mercury intramuscularly, beginning at ¼ gr. and gradually increasing to ¾ grs. daily. She was also given potassium iodide grs. xx three times a day. Her condition improved rapidly, she gained a pound a day on the treatment and within three weeks she was able to walk around the ward.

Case II. Mrs. S., age 56, was admitted to the hospital in 1908 with a diagnosis of acute Bright's disease, with œdema. She improved and was discharged. Admitted again in 1910, diagnosis of chronic Bright's disease with normal blood pressure was made and also a note was made in the physical examination that there were some sensory disturbances in the extremities. In 1912 she was admitted again. I was interned on the ward at that time. She was sent in with a diagnosis of diabetes mellitus with diabetic tabes. She had 5 per cent sugar in her urine. On examination she was thin, pupils sluggish, there was evidence of optic neuritis, deep reflexes were absent, there was hypotonus of the muscles, proximal ataxia, disturbances of sensation. I did a lumbar puncture to rule out syphilis. The fluid showed 90 cells per cmm., Wassermann was strongly positive on blood and spinal fluid. Diagnosis tabes dorsalis, and I also thought that the diabetes could be due to a syphilitic pancreatitis. One year later she died, autopsy diagnosis was syphilis, tabes dorsalis, chronic pancreatitis of syphilitic origin, chronic nephritis.

Case III. A woman whose husband had had syphilis became acutely ill and was diagnosed brain fever, according to her statement. She was admitted to the hospital some time afterwards complaining of headache and marked thirst with polyuria. Lumbar puncture was done, spinal fluid showed increased cell count and Wassermann was strongly positive on blood and spinal fluid. The diagnosis of cerebrospinal syphilis was made and both the headache and polyuria, which may be termed diabetes incipidus since there was no lesion of the kidney, cleared up under mercury treatment.

Case IV. A salesman, about 40 years of age, had always been healthy and had never had a primary. Suddenly, out of the clear sky, he lost his sense of taste and smell and had an uncinate gyrus fit. Lumbar puncture was made, cell count was markedly increased, Wassermann was strongly positive in blood and spinal fluid. He improved under mercury and iodides. He was able to take up to one grain of biniodid daily and was given thirty injections in the first course of mercury, beginning at ¼ gr. and increasing dose up to 1 gr.

Case V. A salesman, age 45, who had had intermittent headaches for a short period, suddenly had an epileptic convulsion. He was admitted to the hospital, lumbar puncture was done, fluid cloudy, increase in lymphocytes and Wassermann was strongly positive in blood and spinal fluid. Under several courses of mercury idodide injections his cell count was markedly reduced, Wassermann became weakly positive in the blood and spinal fluid. The mercury had pulled him down physically so we gave him small doses of salvarsan. He gained weight and has had no more convulsions.

Case VI. An Italian, age 29, teacher, had had unilateral headache which was very severe, gradually he noticed that he was losing his vision in the right eye. He was admitted to the hospital, complaining of terrific headache. There was marked exopthalmos of the right eye, complete blindness, ptosis of lid and paralysis of the eye muscles, reflexes were gone in right eye, but pupil reacted consensually when light was flashed into left eye. Lumbar puncture was done and fluid was clear, no increase in cells, Wassermann was strongly positive in blood and spinal fluid. Under

mercury and iodide treatment his headaches cleared up, exopthalmos disappeared and he regained the use of his eye muscles. Light perception reappeared to a slight degree, the nerve head showed optic atrophy.

Case VII. E. K., female, age 16, occupation factory work. She was brought into the hospital with a paralysis of both legs, marked lordosis as is seen in lumbar Pott's disease, interstitial keratitis, all reflexes of legs gone excepting there was a positive Babinski. Lumbar puncture, cloudy fluid, 200 cells per cmm. Wassermann was strongly positive in blood and spinal fluid. On mercury and iodide treatment she regained the use of her legs, the spinal fluid showed 12 cells per cmm., the last puncture I made, the Wassermann was weakly positive. The mother had tabes dorsalis.

Case VIII. Mrs. L., age 22, orphan, complained of pains in back for a year. Suddenly, one day while getting out of the buggy, her legs gave way and she fell. She was brought to Jacksonville and at the time I saw her there was marked mental cloudiness, paralysis of both legs, paralysis of the bladder and rectal sphincters. The lumbar spine presented the appearance of Pott's disease. There were no reflexes in the legs, not even a Babinski. Sensation was gone excepting subjective pain. Lumbar puncture was done, the fluid was amber colored and coagulated in mass, there was a slight increase in cell count, Wassermann was strongly positive in blood and spinal fluid. I gave her a course of thirty biniodid injections and potassium iodide gr. xx three times a day. She regained bladder and rectal control and at the end of ten weeks she could stand on her feet. She returned eight weeks later for another course of mercury. At the end of this treatment I gave her 0.3 gram salvarsan as a tonic. Last December she returned for a third course of treatment. She walked several blocks to my office every day and said she could walk as well as she could before her illness, but she was unable to run on account of a degree of spasticity. Her Wassermann is still positive.

Case IX. J. M., male, age 32, had primary ten years ago. Complains of inability to walk or stand still and lightening pains down legs and gastric crises. On examination he had Argyi-Robertson pupils, marked Rhomberg, absent knee kicks, Wassermann of blood was strongly positive. He refused lumbar puncture. After 15 injections of biniodide, he was able to stand with eyes closed and pains had decreased. He is continuing the injections.

Case X. M. S., age 39, complained of paralysis of both legs of three weeks' duration and difficulty in voiding. He had a primary lesion 20 years ago. Physical examination was negative excepting for the following evidence: he was unable to stand and had no voluntary control of his legs. Knee and Achilles reflexes absent, Babinski, Oppenheim and Gordon reflexes absent. There were marked disturbances of sensation. Pupillary reflexes normal, eye grounds negative. On lumbar puncture the spinal fluid was clear, cell count 5 per cmm., Wassermann was strongly positive in blood and spinal fluid. After thirty injections of biniodide of mercury, he regained sphincter control, the use of both legs and walks without difficulty.

In the treatment of visceral syphilis with arterial changes and gumma formation the best functional results can be obtained by intramuscular injections of biniodide of mercury and potassium iodide by mouth. You can, however, get some results with mercury given in almost any form, but I have obtained the best results with the biniodide given intramuscularly daily. The initial dose is usually gr. ¼ and every few days I increase the dose from a 1-4 to 1-3, 1-2, 2-3, 3-4, 1 grain or until toxic symptoms arise. After finding the patient's tolerance it is an easy matter to keep within the toxic dose.

The treatment of primary and secondary syphilis in most cases is a problem of de-

stroying the spirochætæ without damaging the host and salvarsan intravenously followed by hydrargyrum intramusclarly give the best results. In the visceral forms of the disease, however, the blood vessels are always involved and when the vessels become obliterated we have the formation of a gumma; that is necrosis of the tissue with round cell infiltration, and through the process of repair we get an overgrowth of connective tissue and an absorption of the necrotic tissue. Salvarsan is much more likely to increase the vascular injury in the arterial type of syphilis and the organ involved lose a greater amount of its blood supply and the ultimate functional result decreased, where as with mercury and iodides the vascular condition is improved, the blood supply increased and the gumma is removed leaving a scar perhaps, and the functional activity of the tissue that is not destroyed is regained. This is well demonstrated in the three cases of syphilis of the cord I have just called to your attention.

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A FEW FACTS CONCERNING COMPLEMENT.

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In discussing this subject it becomes necessary to say a few words concerning immunity and the various theories advanced to explain its production.

Immunity.

Immunity is that which prevents a disease organism from gaining a foothold in the animal body or neutralizes their harmful products or actually destroys the parasite. Immunity is either inherent or acquired, and acquired immunity is either natural or artificial. Examples: Inherent or racial immunity is seen in the Algerian sheep which are immune against anthrax, whereas other sheep are highly susceptible. Acquired immunity is seen in a case of smallpox with recovery, this being a natural acquired immunity. Artificial acquired immunity is seen in vaccination against smallpox. Probably a better classification would be active and passive immunity. Under this classification active immunity embraces any condition which leads to the formation of antibodies by the individual itself. As examples of this, we have vaccination against smallpox and typhoid fever. Passive immunity is any condition in which antibodies themselves are injected into the individual to protect it from a disease. Well-known examples of this form are seen in injections of diphtheria and tetanus antitoxins.

The immunity of an individual depends upon the production in the body of the individual of certain properties known as antibodies or the injection of antibodies into the individual. Antibodies are classified as follows: 1. Antitoxins. 2. Anti-ferments. 3. Agglutinins. 4. Precipitins, and 5. Cytotoxins. Cytotoxins include hemolysins, spermotoxins, nephrotoxins, bacteriolysins, etc. These bodies consist of complement and immune bodies or amboceptor.

Theories of Immunity.

1. The retention theory of Cheavau, which depends upon the production by the bacteria of a substance which, when liberated into the blood stream in sufficient quantity, will prevent their further growth.

2. The exhaustion theory of Pasteur, depending upon the supposition that available food substances for the growth of bacteria which are present in the blood stream, are finally used up by the invading organisms and finding no more available pabulum, they die.

3. The phagocytic theory of Metchnikoff. He believes that the leucocytes are responsible for the destruction of bacteria. He divides the various cells into microphages which include the polymorphonuclear leucocytes and are more active in acute infections and macrophages which include endothelial cells, mononuclear leucocytes and embryonic connective tissue cells which are more active in combating chronic infections.

He explains the presence of apparently free immune bodies in the blood serum as being due to the activity of leucocytes. This is also known as the cellular theory and is essentially of a physical character.

4. The side chain theory of Ehrlich. He conceives the cell as being made up of a central or nuclear portion and a peripheral portion which contains projections, called by him, receptors, each of which is capable of uniting with certain food or toxic substances with which they may come in contact. This theory explains not only metabolism but also resistance to infection. The receptors are divided into three orders. The receptors of the first order consist merely of a haptophore portion which is capable of uniting with a simple substance, after which union the cell is either destroyed or is capable of utilizing the attached molecule. Receptors of the second order are made up of a haptophore portion and a toxophore portion and are for the purpose of combining with more complex molecules. The substance combining with the haptophore portion of a receptor of the second order is utilized by the activity of the toxophore portion of the receptor. It will be seen that cells having receptors of the first and second order are capable in themselves of utilizing or destroying molecules which attach themselves to them. Receptors of the third order are for the purpose of utilizing still more complex molecules. They consist of two haptophore portions, one which is capable of attaching the molecule and the other which is capable of attaching the complement. After this union the cell is then capable of utilizing the attached molecule through the agency of the complement.

Ehrlich's theory depends upon the overproduction theory of Weigert who assumes that when any injury occurs to an organism, nature will not only repair the injury but will produce an excess of the repair material, as for example, the production of scar tissue. It will be seen then that when a substance is introduced which will destroy a receptor, the cell will not only replace this receptor, but will go ahead and manufacture an excess. These will then be pushed off the cell into the blood stream. Antibodies are therefore free receptors. Antitoxin consists of receptors of the first order. Agglutinins and precipitins are free receptors of the second order, and cytotoxins are receptors of the third order. Erhlich's theory is also known as the humeral theory and is essentially a chemical one.

Complement Fixation Tests.

Complement fixation tests are based on the well-known fact that antigens and their specific antibodies will combine with complement, this reaction being invisible. We therefore add a hemolytic system composed or red blood cells and their amboceptors as an indicator. The fact that no Bordet-Gongou reaction can be performed without complement, makes a discussion of this substance of paramount importance.

History.

In 1876 Landois described the hemolytic action of fresh blood serum on the red blood cells of animals of certain species. Traube and others brought out the fact that animals could withstand the injection of comparatively large amounts of septic material. Between the years 1886 and 1890, Fodor, Nuttall, Buchner and others finally proved the bactericidal properties of fresh blood serum. Buchner showed that the active principle causing lysis was very labile and could be inactivated by heating to 55 C., by dialyzing or by diluting with distilled water. He called this active principle alexin. In 1899 Bordet discovered the fact that alexin was composed of two substances, a thermostable sensitizing substance, called by him, substance sensibilitrice and a thermolabile substance which he designated as alexin. Later in the same year Ehrlich and Morgenroth confirmed Bordet's work, and to the thermostable substance gave the name of amboceptor and to the thermolabile the name addiment or complement. Bordet adhered to the term alexin, but does not

consider it as originally used by Buchner to cover both substances.

Buchner believed complement to be a true secretory product of the leucocytes. Metchnikoff does not believe that complement exists preformed in the blood serum, but that it is only liberated upon the disintegration of the white cells. Hankin believed that the eosinophiles are responsible for the production of complement. In favor of Metchnikoff's view is the fact that leucocytic extracts are known to be bactericidal and can act without the presence of neutral salts. However, cholera vibrios and typhoid bacilli are scarcely affected by leucocytic extracts, also anti-cholera and anti-typhoid sera will not be reactivated when leucocytic extract is added to them. This experiment seems to show that leucocytes, *per se*, can not produce all the complements, and are therefore not the sole source of complement production. Complement occurs in blood plasma and is increased to a slight extent as serum is left in contact with the blood clot. This is due, no doubt, to the continual disintegration of leucocytes and is another argument in favor of Metchnikoff's view. According to Muller and Dick, the liver, pancreas and other organs may be regarded as sources of complement. The evidence, however, points to the leucocytes as being the chief source of complement, the liver being concerned in its production only through its activity in blood destruction.

Nature.

The true nature of complement is unknown, but we cannot pass this subdivision of the discussion of complement without mentioning the different views on the subject and without citing, in a brief way, the experiments in support of each. Metchnikoff believes complement to be an enzyme and gives to it the name of cytase. Its action in the various bacteriolytic and hemolytic tests, certainly suggests very strongly that it possesses zymotic properties, *i. e.*, it cannot act alone, but only through the preparatory action of an amboceptor, just as an enzyme cannot act without a proenzyme or zymogen. The chief objections to this view were the facts that a definite quantitative relationship seemed to exist between the complement and the amount of cells upon which it could act, and that it did not digest the stroma of the red blood cells. However, Kiss in 1909 showed that the quantitative relationship between complement and cells is not a strict and regular one, but depends rather upon the concentration of the complement. Liefmann and Cohn claim that the fixation of complement during hemolysis is not due to its union with the sensitized cells, but is due to fixation by the end products of the reaction, principally the stromata of the red blood cells. Observations by Dick seem to point to the fact that the stroma of the red blood cells is digested and that this leads to the liberation of hemoglobin. These experiments lend further support to the view that complement is an enzyme. Hankin, Buchner, Kossel and Vaughn believe complement to be a nucleo-proteid. In fitting complement into his side chain theory Ehrlich conceives it to be of simple structure, similar to that of toxin, consisting of a haptophore portion capable of uniting with the complementophile haptophore of an amboceptor, and a toxophore group, the lytic portion, called by some authorities the cytophile or zymophore group. The zymophore group is very unstable and is destroyed by heating to 55° C. for thirty minutes. Serum thus treated is said to be inactivated. The same change takes place when serum is allowed to stand at room temperature for 48 hours. Complement, after having the zymophore group destroyed, is known as complementoid, a substance which is analagous to toxoids and agglutinoids. Noguchi has shown that soaps, isolated from blood and other tissues, and that the salts of fatty acids, especially the cleates, are hemolytic. Kyes found that amboceptor could be activated not only by the complement in the blood serum but also by some substance within the erythrocytes

themselves. This substance he called endocomplement, and in an endeavor to discover its nature, he isolated from the red blood cells lecithin and cholesterin in pure form. He found that lecithin was hemolytic and cholesterin anti-hemolytic. Noguchi and Liebermann's work seems to show that complement is a mixture of albumin and lipoid.

Complement Splitting.

This is carried out by treating the serum with HCl (Sachs,) CO_2 gas (Liefman), acid or alkaline phosphates (Michaelis and Skwissky, or by dialyzing against distilled water (Ferrata). If the splitting is successful, one part is supposed to be contained in the globulin fraction and the other part in the albumin fraction. The one in the globulin fraction is known as mid-piece, and that in albumin fraction as the end-piece. The mid-piece is inactive and the end-piece is active. In other words, the mid-piece corresponds to the haptophore portion of the complement and the end-piece to the toxophore. Bronfenbrenner and Noguchi, however, by removing the inhibitory action of the acids and alkalis used in the process, have shown that both fractions contain parts of the complement and that this phenomenon is nothing more or less than inactivation.

Multiplicity of Complement.

At the present time this subject is not of great practical value, but theoretically it would seem to be of great importance and once proven satisfactorily, no doubt, the added attribute of specificity might be given to complement. Bordet adheres to the unity of complement on the basis that the same complement can activate both a bacteriolytic and a hemolytic amboceptor, and furthermore that an excess of either amboceptor will absorb all the complement. Metchnikoff claims two complements or cytases as he calls them. One a bacteriolytic and the other a hemolytic cytase. He believes that the bacteriolytic cytase is derived from the microphages or the polymorphonuclear leucocytes and that the hemolytic cytase is derived from the macrophages which include endophelial cells, mononuclear leucocytes and embryonic connective tissue cells. Ehrlich, Morgenroth, Sachs, Wassermann, Wechsberg, Marshall and others believe that many complements are present, but that the amounts of each may vary in different sera. The fact that complement is so labile makes this difficult to prove, but they advance the following observations:

1. A serum which acted with different hemolytic amboceptors was digested with papain (20 c.c. of serum and 3 c.c. of a 10-percent solution of papain) at incubator temperature for 45 minutes. The complement for one amboceptor was destroyed.

2. This same serum was also treated with soda solution (10 c.c. of serum with 1 c.c. of 7-percent solution of soda) for one hour. Some complements were destroyed and others weakened.

3. Different red blood cells were sensitized with homologous amboceptors and then added in varying amounts and for varying lengths of time to fresh blood serum. Some complements were destroyed and others weakened.

4. By means of anticomplements, different complements can be demonstrated in one serum.

5. An anticomplement for one complement present in guinea-pig serum was found in ascitic fluid.

Deviation or Deflection of Complement.

This can be shown by combining normal serum plus bacteria with varying amounts of amboceptor, when it will be seen that no lysis occurs until a certain amount of amboceptor has been added and that amounts larger than this cause a diminution of lysis. No satisfactory explanation of this phenemonen has, up to the present time, been advanced. Neisser and Wechsberg explain it in the following way: Complement in the presence of an excess of amboceptor combines not only with amboceptor and antigen, but also with free amboceptor. In other

words, when more amboceptors are introduced than can be taken up by the antigen present some of the complement attaches itself to the free amboceptors and consequently lysis is diminished. This theory is untenable because complement is not able to unite with free amboceptor.

Anticomplement.

The injection of complement or complementoid into an animal will produce anticomplement. This may be demonstrated by treating a complement with its anticomplement, when it will be found that the serum will be inactive. Auto-anticomplement may render the subject much less resistant to a certain infection, as complement necessarily plays an important part not only in the destruction of bacteria, which may enter the host, but also in the digestion and solution of other albuminous bodies. Auto-anticomplement has never been observed for the reason that an organism does not contain receptors for complement present in itself. However, the injection of serum from an animal containing complement which is almost identical may lead to its production. Muller, in 1901, discovered anticomplement in normal sera. Besredka in the same year demonstrated anticomplement in the blood of man, rabbit, guinea pig, fowl and goose. Wassermann has produced anticomplement by injecting the washed leucocytes of rabbit into guinea pigs.

Complement Fixation.

In routine complement fixation work the serum of guinea pigs is used as complement. The blood is obtained either by bleeding the animal to death, if a considerable amount is desired, or by etherizing a guinea pig and drawing the blood direct from the heart. This latter method is, of course, the method of choice, when but few tests are carried out and where guinea pigs are scarce. After allowing the blood to stand over night at room temperature, the serum is withdrawn and diluted to the desired strength with normal saline solution. The dilutions commonly used are a 1 to 10 or a 1 to 20. In either case the complement must be titrated with the other reagents. Complements must be titrated not only for the hemolytic dose, but also to make sure that complement in itself is not hemolytic.

Preservation of Complement.

Owing to the extreme lability of complement, preservation is difficult. Dr. Lloyd Thompson dilutes fresh guinea pig serum 1 to 1 with an 8.1-percent solution of NaCl and seals two c.c. of this mixture in ampules. To use the contents of one ampule is diluted in 8 c.c. of distilled water. This brings the salt content to .9 per cent. He has used ampules six weeks old.

References.

Nuttall, Marshall, Hiss and Zinsser, Simon, Stitt, Park and Williams, Zinsser, Kolmer, Journal A. M. A., Jordan, Adami, and Muir and Richie.

PROPAGANDA FOR REFORM.

Dr. Pierce's Pleasant Pellets.—The A. M. A. Chemical Laboratory reports that the pills responded to tests for emodin and aloin. Essentially, Pierce's Pleasant Purgative Pellets appear to be an ordinary laxative pill. That the active principle of aloes was found in the pills is of interest in view of the fact that the leaflet advertising Pierce's Pleasant Pellets warns the public against the use of purgatives composed of aloes. (*Jour. A. M. A.*, Dec. 4, 1915, p. 2025.)

Nose-Ions. — The A. M. A. Chemical Laboratory reports that the circular matter for "Nose-Ions" is a crude attempt to impose on a scientifically trained profession with pseudo-scientific patter about ions, ionic dissociation and the positive and negative charges of ions. It appears that Nose-Ions is essentially an ointment consisting of a petrolatum base, containing some odorous principles such as camphor, menthol and eucalyptus, with some salicylic acid and some quinine. (*Jour. A. M. A.*, Dec. 4, 1915, p. 2026.)

Ozomulsion. — This "patent medicine" long sold as a consumption "cure" has been declared misbranded under the Food and

Drug Act, the therapeutic claims being both false and fraudulent. The preparation was found to be an emulsion of cod liver oil, with glycerine and phosphorus compounds of calcium and sodium. (*Jour. A. M. A.*, Dec. 18, 1915, p. 2184.)

Dr. Wittington's Treatment for Consumption.—This preparation was examined in the A. M. A. Chemical Laboratory. From the analysis it appears that Dr. Whittington's Treatment for Consumption is a flavored syrup devoid of potent ingredients other than alcohol. Dr. Whittington is a member of the Medical Society of California. (*Jour. A. M. A.*, Dec. 18, 1915, p. 2184.)

Rogers' Consumption Cure. — Rogers' Consumption Cure and Cough Lozenges and Rogers' Inhalant were advertised for the treatment of diseases of the lungs, etc. The government chemists reported that the first consisted of sugar lozenges, containing a small amount of gum and a trace of oil of rosemary. The inhalant was found to be an alcoholic solution of volatile oil, chiefly rosemary. The government held the therapeutic claims made for these preparations false. The owners having made no defense, they were fined. (*Jour. A. M. A.*, Dec. 18, 1915, p. 2185.)

Mist. Helonin Comp.—The only available information in regard to the composition of Mist. Helonin Comp., Schlotterbeck and Foss, is a statement in a circular that the active ingredients are helonin, senecin and avenin and the statement on the label that it contains 45 per cent alcohol. The alcohol content is that of strong whiskey. The practically inert drugs asserted to be contained in it would not in the least interfere with its use as a cordial. On the basis of the information supplied by the manufacturer, Mist. Helonin Comp. may be classified as an objectionable and worthless nostrum—unless we regard the alcohol as of value. (*Jour. A. M. A.*, Dec. 18, 1915, p. 2186.)

Incompatibility of Quinine with Aspirin. — Experiments have shown that weak acids, such as acetylsalicylic acid (aspirin), citric, malic, acetic or tartaric acid under the influence of heat may convert quinine into its poisonous isomer quinotoxin and cinchona into cinchotoxin. The danger of the formation of quinotoxin in the body can not be great. Ready-made mixtures of quinine or cinchona preparations with weak organic acids should be avoided. (*Jour. A. M. A.*, Dec. 18, 1915, p. 2187.)

Salvarsan Made in U. S.—Because of the shortage due to the war, salvarsan is made and offered for sale under its chemical name to physicians and hospitals urgently in need of it by the dermatologic laboratories of the Philadelphia Polyclinic. Dr. Jay F. Schamberg, the director of the Department of Dermatological Research, states that the product made by the dermatologic laboratories has been employed on hundreds of cases with excellent therapeutic results and with no reports of accident or untoward complications. (*Jour. A. M. A.*, Dec. 18, 1915, p. 2179.)

Hydragogin.—The Council on Pharmacy and Chemistry reports that Hydragogin (C. Bischoff & Co.), advertised as a "most wonderful diuretic and cardiac tonic," is a shotgun mixture of semi-secret composition, marketed under a therapeutically suggestive name and advertised by means of unwarranted therapeutic claims. Hydragogin is said to be a preparation of digitalis, strophanthus, squill and a saponin. The report explains the objection to the administration of digitalis and strophanthus is fixed proportion because of the varying rates of absorption and excretion of these two drugs. It further cautions that since digitalis bodies must often be given to the point of beginning toxic action in order to obtain the full therapeutic effect, it is obvious that the administration of a mixture of digitalis, strophanthus, saponins and squill is especially liable to induce serious toxic effects which cannot be distinguished from the symptoms of the disease. (*Jour. A. M. A.*, Sept. 4, 1915, p. 894.)

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MEDICAL PREPAREDNESS.

There has recently been organized a Committee of American Physicians to ascertain the availability of medical men throughout the country for medico-military service in the event of a crisis at any time. That a complete survey of the available resources of the country is a wise step is evidenced by looking back to Spanish-American war times in 1898, and by reviewing the opening period of the present conflict now going on among the European nations.

As General Wood recently stated in an address before the American Educational Association, "History is too superficially taught here. How many of our children leave school with a knowledge of the fact that we have never fought a war without aid when we engaged a first-class power? * * * We have altogether too much of the Fourth-of-July oratory, all too much of the type of man who speaks of a million springing to arms between sunrise and sunset. We have been sitting up nights for three weeks to see 30,000 men spring, and it is a very heavy spring."

The committee above referred to has recently addressed the following letter to all State and various other medical organizations:

"Through the Hay bill in the House and the Chamberlin bill in the Senate, Congress has for the first time in the history of the country provided for the enrollment of an adequate percentage of physicians to supply the needs of the Regular Army and the National Guard. It has also provided for the enrollment of a large number of physicians in the Officers' Reserve Corps which replaces the Medical Reserve Corps. It would, therefore, seem appropriate that members of our several committees and representatives of the various medical organizations, especially State and County societies, should let their respective representatives in the Senate and House know that the medical profession appreciates that action. If the individual representative

voted for an adequate medical personnel, he will be pleased to receive the approbation of the medical profession of his community. If he failed to support that feature of the bill, he will realize that the judgment of the medical profession should be more fully respected in the future.

"It has been suggested that on purely patriotic and non-partisan lines, the State committees, and the State and County societies might indicate their approval of the provisions above referred to, and their desire that in the future their representatives provide adequate facilities for the equipment and training of a sufficient number of medical officers to meet any possible demands. In this connection, it should be remembered that in the event of a grave international conflict, all physicians who are called to the colors must be officers; and that efficient officers can not be made quickly. Everyone, even the most ardent pacifists, should see the wisdom of giving adequate equipment and training to the only group of people whose duty it is, even in the thick of battle, to relieve suffering, to prevent mutilation and to save life.

"Inasmuch as medical and surgical services are essentially individual services, rendered to individual patients, it is not sufficient to have a few well-trained hospital and other medical units in the service. All units that may be called should be fully equipped and adequately trained for their new duties. This means that equipment and training should be provided for at least twenty thousand physicians and surgeons in the Medical and Officers' Reserve Corps.

"Your active interest in, and your prompt attention to this matter are earnestly desired. Kindly take it up at once with your State committee and with the officers of your county and other representative local medical societies."

THE JOURNAL takes this means of communicating the above to all county organizations and individual members throughout the State, and wishes to urge the profession to give the committee the hearty cooperation and support it is enitled to. This is another instance where we have a distinct duty to perform. Let us up and do it.

OH, MR. ADVERTISER!

In the last issue of THE JOURNAL we called especial attention to our usual monthly bulletin appearing on an advertising page. It was addressed to the members of the Florida Medical Association and other subscribers of THE JOURNAL and reminded them of their obligation to patronize our advertisers. As has been repeatedly stated in these columns, a successful journal has to maintain a well-balanced proportion of advertising pages to other matter.

We believe our advertisers are securing a reasonable patronage for our contracts are being renewed, and the number of advertising patrons constantly increasing. However, always having in view the improvement of our Journal, in this issue we directly address the advertisers.*

All successful mercantile establishments appreciate the value of and the necessity for advertising the products in which they trade. THE JOURNAL OF THE FLORIDA MEDICAL ASSOCIATION has proved itself an effective advertising medium. It merits your patronage, Mr. Advertiser. Frankly, we will appreciate your using our advertising columns and are confident that you will find these will open for you a market among the medical profession of this state.

This Journal is owned by the Florida physicians; they are naturally interested in its welfare. As an advertiser in this publication you obtain a point of personal contact with each member of the State Association—the owners of this Journal.

THE PREVENTION OF DISEASE.

During the past few years we have heard so much of the wonderful advancement made by medical science in bettering health

*See Bulletin 8 on adv. page vi.

conditions in the tropics, that reports concerning the good health of large bodies of men laboring in the tropics under sanitary control excite little comment.

The report of Major E. E. Persons, Acting Chief Health Officer of the Panama Canal Zone, for the month of May contains the following three especially significant statements: "The last case of smallpox contracted on the Isthmus was in 1907 .... The last case of yellow fever contracted on the Isthmus occurred in November, 1905, ... The last case of bubonic plague contracted on the Isthmus occurred in August, 1905."

The civil population of this and other countries can learn a useful lesson by well considering these statements. We have many preventable diseases throughout the world today, causing innumerable deaths and producing much misery and suffering, that could be stamped out by our health authorities if they could only secure the active cooperation of the individual. In military zones this can be commanded in civil life, however, it has very largely to be solicited. Without it the Health Officer is practically helpless, with it he could soon become supreme. In other words our sanitary officers are able to prevent as many of the preventable diseases as the public will allow them to.

ANOTHER STATE JOURNAL.

We are pleased to welcome another state journal into the realms of medical literature. *The Nebraska State Medical Journal* made its initial appearance during the past month, and as their official organ is a credit to the Nebraska State Medical Association.

The first issue contains thirty-two pages of reading and twenty pages of advertising matter.

It is pleasing to note that "No advertisement of a preparation suitable for analysis by the Council on Pharmacy and Chemistry of the American Medical Association will be accepted until the endorsement of the Council is guaranteed."

THE JOURNAL extends greetings to this new publication and wishes for it a prosperous career in the interests of organized medicine.

RURAL HEALTH AMERICA'S FIRST DUTY.

Shortly after Congress convened, last winter, Senator Randsdell of Louisiana, chairman of the Senate Committee on Public Health and National Quarantine, introduced Senate Bill 2214, appropriating $500,000 for the use of the United States Public Health Service, to be used in investigating and encouraging the adoption of improved methods of rural sanitation and especially for devising and demonstrating effective measures against malaria and typhoid, instructing farmers in the prevention of these diseases, carrying on necessary investigation and surveys, and cooperating with State and local authorities to eradicate these diseases in rural districts. Friday, July 14th, in the Senate, Senator Randsdell presented a strong argument for his bill. He reviewed the history of health legislation in the United States, showing that local regulation had generally been ineffective and that most of our advances in Federal legislation had resulted from disastrous experiences with epidemic diseases. As the representative of the Southern state in which the inroads of yellow fever have been perhaps most severe, Senator Randsdell is able to speak with authority and from personal observation. New Orleans' recent epidemic of bubonic plague and the brilliant work of the Public Health Service in stamping it out was vividly described. "Never again will there be an epidemic of bubonic plague in New Orleans," he said. "The people of that city realized that the conquest of this disease was one for the Federal government. * * * Today, as a result of the campaign against yellow fever and the campaign against bubonic plague, New Orleans is one of the

healthiest cities in the world." After reviewing the work of the Public Health Service and showing the limited means available, Senator Randsdell showed that in this country, in any line of progress, education is indispensable, and that, although much educational work has been done, and although the death rate throughout the nation has fallen during recent years, this decline has been much greater in urban than in rural communities. He then discussed the economic and vital loss due to malaria and typhoid, showing that these two diseases alone cost the United States over $900,000,000 each year, and that both diseases are almost entirely preventable. Comparing the 1915 appropriation for the prevention of human disease with that for the prevention of diseases of animals, Senator Randsdell called attention to the fact that the total amount appropriated last year for human welfare was less than two million dollars, while the amount appropriated for animal and plant welfare was nearly six million. "The problem of rural sanitation," he declared, "is not a local problem, but one which concerns the health and physical integrity of our entire nation." Senator Randsdell's speech in favor of the passage of his bill is one of the strongest public health utterances ever made before Congress. While the bill is simple in its phraseology and provisions, its passage would result in widespread and lasting benefit to the entire country, and would greatly strengthen the Public Health Service. If Congress will pass this measure, it will deserve the gratitude and thanks of the public and especially of our rural population.—*Journal of the American Medical Association.*

PREVENTION OF INFANTILE PARALYSIS.

To control the present epidemic of infantile paralysis, according to a statement issued by the United States Public Health Service today, the chain of infection between persons harboring germs of the disease and the well members of the community should be broken. Infantile paralysis is probably caused by a very minute organism found in the nasal, mouth and bowel discharges of those who have the disease or who are carriers of the germ without themselves suffering from the ailment. All of the steps in the spread of the infection are not known but if this germ can be prevented from passing from the infected to the well person, the disease will cease.

Infantile paralysis is not a disease of recent origin. Sporadic or scattered cases have occurred throughout the country for many years but it is only during the last decade that the infection has assumed epidemic proportions in the United States. The present epidemic in New York, on account of its magnitude and virulence, has awakened the residents of many communities to the danger of the importation of the disease into their own midst. This danger is real, but if due precautions are exercised it is believed that the epidemic will subside.

The actual control of the present epidemic must be left to the city, State and Federal health authorities. These organizations will properly quarantine and care for affected persons, prescribe sanitary measures and limit as may be necessary the travel of individuals in order to protect neighboring districts from the infection. Individuals and communities, however, can do much toward their own protection.

Poliomyelitis is probably spread directly or indirectly, through the medium of infective secretions. Account must, therefore, be taken by communities of every means by which such secretions are disseminated. Promiscuous expectoration should be controlled. The common drinking cup affords a method for the interchange of material of this nature and should therefore be abolished. Rigid cleanliness of glasses and utensils at soda fountains, in saloons and other public places should be enforced. Flies, roaches and other vermin, by coming in contact with infective secretions, may pos-

sibly convey them to our food and thus directly bring about the development of disease. Therefore eliminate insects. Street and house dust bear a definite relation to the spread of many infections and it is not unreasonable to presume that they may be a factor in the dissemination of infantile paralysis. Maintain strict cleanliness of streets, yards and alleys in order to prevent the breeding of insects and other vermin. See that all garbage and waste are properly cared for and collected at regular and frequent intervals. Guard all food supplies, especially milk and other perishable products. Digestive troubles of children arising from the ingestion of food of questionable quality may lower resistance. Assemblies of children in infected localities are to be discouraged, if not actually forbidden. While the above measures are in a sense general, and applicable to many epidemic diseases, their importance should not be overlooked.

Individual preventive measures may be thus summarized:

Summon a physician at once and immediately notify the health officer of the presence of the disease. If the disease is present in the community, medical aid should be sought whenever a child is sick, no matter how light the illness; many cases of infantile paralysis begin with a slight indisposition. Should the illness prove to be infantile paralysis, isolate the patient, place a competent person in charge, and reduce all communication with the sick room to a minimum. Hospital care is preferable, not only for the child but in order to better safeguard against the spread of the disease. The sick room should be well ventilated and screened. Nasal and mouth secretions should be received in cloths, placed in a paper bag and burned. The clothing of the child, the bed linen, and the excretions should be disinfected in the same manner as for typhoid fever, that is by boiling, the long continued application of 5 per cent carbolic, or other well-recognized disinfectant. The same is true for dishes and drinking vessels. Nurses should exercise the same precautions as regards cleanliness of hands in caring for infantile paralysis patients as for those afflicted with other infectious diseases.

A child may convey the disease to others even after a lapse of several weeks. For this reason quarantine should be maintained for a considerable period, usually from six to eight weeks, and the above precautions should be adhered to during this time. Disinfection of the room following recovery is advisable.

Cancer Department

"In the early treatment of cancer lies the hope of cure."

AMERICAN SOCIETY FOR THE CONTROL OF CANCER

TEN CANCER DON'TS.

1. Don't procrastinate.

2. Don't forget your duty to the patient who consults you during the cancer bearing age about some apparently trivial lesion which might be a precursor of cancer.

3. Don't delay in advising the removal of the jagged tooth which is causing a spot of chronic irritation on the tongue or inside the cheek.

4. Don't wait for an unhealed fissure of the lip to become clinically malignant before advising its removal.

5. Don't prescribe local applications for a chronically inflamed wart or mole. Remove it.

6. Don't prescribe any local treatment for a persistent lump in the breast. If it is benign, the application will do no good. If it is malignant, the massaging may hasten metastasis. The only safe treatment for lumps in the non-lactating breast is their removal.

7. Don't treat eczema of the nipple and areola without first ruling out duct cancer as its cause.

8. Don't prescribe for irregular vaginal bleeding until you have made an exhaustive

examination and eliminated cancer as the cause.

9. Don't forget that rectal bleeding does not *always* mean hemorrhoids: it sometimes signifies cancer of the rectum.

10. Don't allow yourself to become a pessimist concerning cancer. It is unquestionably curable in the early stages when it is still a local growth.

DEATH OF DR. J. B. MALONEY.

Word reaches us just as we are going to press of the sudden death of Dr. J. B. Maloney of Key West. Dr. Maloney was taken suddenly ill while in Philadelphia. A more extended notice will appear in the September number of THE JOURNAL.

THE NATIONAL BOARD OF MEDICAL EXAMINERS OF THE UNITED STATES.

The need of a standard medical examining body for the whole United States and its Territories (tributary thereto) has occasioned the organization of The National Board of Medical Examiners. It is a voluntary board, the members of which are selected from the Medical Corps of the Army, the Navy, and the Public Health Service, the Federation of State Examining Boards, and other representative organizations, and the medical profession of the United States.

The aim of this board is to establish a standard of examination and certification of graduates in medicine, through which by the cooperation of the individual Boards of Medical Examiners, the recipients of the certificates of the National Board of Medical Examiners may be recognized for licensure to practice medicine.

The policy of the board is to conduct its examinations on a broad scientific basis of such a high yet practicable standard that the holders of its certificates will receive universal recognition.

The independent action by the board is furthered by the financial and moral support of the Carnegie Foundation.

The original board consists of fifteen members, as follows, and remains unchanged, except for the loss of the founder and secretary Dr. Rodman, who died on March 8, 1916. At a meeting June 13, 1916, Dr. W. L. Bierring, of Des Moines, Iowa, was elected to the board:

Surgeon-General W. C. Braisted, U. S. N., President.

Dr. W. L. Rodman, Secretary.

Colonel Louis A. LaGarde, U. S. A., Ret., Treasurer.

Surgeon-General W. C. Gorgas, U. S. A.

Surgeon-General Rupert Blue, U. S. P. H. S.

Medical Director E. R. Stitt, U. S. N.

Assistant Surgeon-General W. C. Rucker, U. S. P. H. S.

Dr. Herbert Harlan, Federation of State Medical Examining Boards.

Dr. Isadore Dyer, New Orleans, La.

Dr. Victor C. Vaughan, Ann Arbor, Mich.

Dr. Henry Sewall, Denver, Col.

Dr. Louis B. Wilson, Rochester, Minn.

Dr. E. Wyllys Andrews, Chicago, Ill.

Dr. Horace D. Arnold, Boston, Mass.

Dr. Austin Flint, New York, N. Y.

The permanent organization of the board will consist of the three Surgeon-Generals and one other representative from each of the Government Medical Services, three representatives of the Federation of State Medical Examining Boards, and six members chosen at large from the medical profession by the National Board of Medical Examiners.

The official domicile of the board is Washington, District of Columbia.

REQUIREMENTS FOR ADMISSION TO THE EXAMINATION.

Satisfactory completion of

(*a*) *High School.* A four-year high school course.

(*b*) *College.* Two years of acceptable college work, including physics, chemistry, biology, and a modern language.

(*c*) *Medical School.* Graduation from a Class "A" medical school. (American Medical Association classification.)

(*d*) *Hospital Training.* One year as interne in an acceptable hospital or laboratory.

The above requirements apply to graduates of medical schools in 1912 and thereafter. The board may accept equivalent credentials in the case of graduates previous to 1912.

EXAMINATIONS.

The board has been given spacious rooms in the Armory Medical Museum for conducting its examinations. They will be conducted primarily by members of the board, and will be written, oral, and practical, including the examination of cases. In addition to the written examinations held in the Armory Medical Museum, oral, written, and laboratory examinations will be held also in the Army and Navy Medical Schools, and in the Hygienic Laboratory of the Public Health Services, these facilities, as well as the Government hospitals wherein will be held clinical examinations, having been placed at the disposal of the board for the purpose.

Credentials must be presented to the board sufficiently early for investigation. If adequate time is not allowed for this purpose, credentials may be rejected.

The following subjects will be included:

1. *Anatomy*: Microscopic—Embryology, histology and organology, neurology. Gross —Osteology, dissection. Applied—Regional, topographical, surgical.

2. *Physiology.*

3. *Chemistry and Physics*: Organic, physiological, physics.

4. *Pathology and Bacteriology*: Bacteriology, microscopic pathology, gross pathology, surgical pathology.

5. *Materia Medica, Pharmacology and Therapeutics*: Materia medica, pharmacology, therapeutics and prescription writing, electrotherapeutics (including radiotherapy).

6. *Medicine*: Theory and practice, physical diagnosis, laboratory diagnosis, diseases of nervous system (including psychiatry), diseases of children, tropical medicine.

7. *Surgery*: General, including minor surgery, operative surgery. Special Surgery —Ear, nose and throat, eye, genito-urinary, orthopedics, radiology, skin diseases, syphilis and venereal diseases.

8. *Obstetrics and Gynecology.*

9. *Hygiene and Sanitation*: Sanitary science, epidemiology, vital statistics, State medicine.

10. *Medical Jurisprudence.*

SUBJECT VALUES.

1. Anatomy	100
2. Physiology	75
3. Chemistry and Physics	75
4. Pathology and Bacteriology	100
5. Materia Medica, Pharmacology, and Therapeutics	75
6. Medicine	200
7. Surgery	200
8. Obstetrics and Gynecology	100
9. Hygiene and Sanitation	50
10. Medical Jurisprudence	25
Total	1000

Passing grade is an average of 75 per cent.

A candidate receiving a mark below 50 per cent in one subject or below 65 per cent in two subjects, fails.

Candidates failing at the first examination may register for a second examination at the end of one year. A third examination will not be allowed.

It is expected that the examination will cover about one week.

No fee is charged for the examination itself, but a registration fee of five dollars will be required.

The first examination will be held in Washington, beginning October 16, 1916.

CERTIFICATION.

Candidates who have been successful in passing the examination and are approved by the board, will be granted certificates.

This certificate is not a license to practice medicine, nor does it exempt the holders thereof from complying with the legal requirements of the States in which they desire to practice; but it will be evidence of high attainment in medical knowledge; and will, the board believes, soon be accepted by State boards as evidence of qualification for licensure.

Further information and application blanks may be obtained from the secretary,

DR. J. S. RODMAN.
2106 Walnut Street, Philadelphia, Pa.

Reviews from Current Literature

PAINLESS LABOR

Edgar, J. C.: Painless Labor. Trans. Amer. Gyne. Assn, May, 1916. Abs. from International Abs. of Surgery.

Edgar's conclusions are as follows:

A satisfactory method consists in the use of nitrous oxide-oxygen analgesia or obstetric ether or chloroform for the second stage, pushed to anesthesia for the perineal stage; possibly forceps delivery with vapor anesthesia to eliminate part of the second stage.

Nitrous oxide-oxygen analgesia or anesthesia is superior to any other during labor because of its oxytonic action.

Eventually an established method of painless labor might be rightly considered as a public health measure.

Lessening or abolishing the pain of labor might in the future limit birth control and criminal abortion.

Drug addiction after a prolonged drug narcosis in the neuropathic is a possible contingency.

Dangers to the unborn or newly-born child are negligible when drug narcosis is limited to the first stage. G. R. H.

PITUITARY EXTRACT

Hingston, C. A. F.: The Uses of Pituitary Extract in Labor at the Government Maternity Hospital, Madras. Indian Med. Gaz., 1916, LI, p. 81.

Hingston reports the results of 1,000 doses of pituitary extract given to different women in different stages of labor. He divides the cases into the following groups: (1) Treatment with pituitary extract alone; (2) treatment with pituitary extract and small doses of morphia; (3) treatment with pituitary and large doses of morphia; (4) treatment with pituitary extract, morphia and scopolamine (twilight sleep); (5) treatment with pituitary extract and chloroform; (6) cases of Caesarean section in which pituitary extract was given five minutes before; (7) cases of induced labor in which pituitary extract was given to induce labor.

The earliest time of administration in groups 1, 2, 3, 4 and 5 was when effacement of the cervix occurred. Dilatation of the os was not necessary.

The severe pains following the pituitrin was relieved best by chloroform or morphia (1-4 gr.). Large doses of morphia (1 gr.) produced "blue babies," as also did twilight sleep; two babies died with the latter procedure, although the heart beat strongly for an hour The best results were obtained with chloroform.

Indications were: (1) weak pains; (2) to hasten delivery with normal pains; (3) for a floating head—when there was no disproportion—as a substitute for high forceps; (4) as a prophylactic against postpartum hemorrhage; (5) to prevent bleeding in Caesarean section.

The place of administration was the arm, as better action was secured from the arm than from any other part.

To induce labor, pituitary extract was given and at the same time the membranes were separated with the finger for three-fourths of an inch about the os. G. R. H.

INFANTILE PARYLISIS

Flexner, Simon: The Nature, Manner of Conveyance and Means of Prevention of Infantile Paralysis. Jour. A. M. A., July, 1916, Vol. LXVII, p. 279.

It is definitely determined that infantile

paralysis is caused by the invasion of the spinal cord and brain by a small, filterable microorganism which has been secured in artificial culture and which is visible under high powers of the microscope. The infectious virus is constantly found in the mucous membrane of the nose, throat and intestines of persons suffering from the disease. Is not found in the circulating blood. Demonstration of the microorganism is too difficult to permit of it being utilized as a diagnostic aid. The virus can best be detected by inoculation tests on monkeys, which animals develop a disease corresponding to infantile paralysis of human beings. Through personal contact the mucous membranes of the nose and throat of healthy people may become contaminated with the virus and such individuals may either contract the disease or may become true "carriers." The virus leaves the body in the secretions of nose, throat and intestines. It enters the body by way of mucous membranes of nose and throat and finally penetrates the brain and spinal cord. The virus withstands extreme summer temperature after being discharged from the body, withstands complete drying and the action of mild chemicals. Its survival is favored by darkness, hindered by bright daylight and readily destroyed by exposure to sunshine. Insects only stand in a causal relation through becoming contaminated and mechanically conveying the virus to food or directly to nasal or buccal mucous membrane.

Domestic animals have not been proven carriers of the disease. The usual period of incubation is within eight days, and the period of infectivity of a diseased individual is no longer than six weeks. One attack confers subsequent immunity, and the blood serum of recently recovered human beings and monkeys has been used in an effort to confer passive immunity and for its action as a curative agent. Passive immunity thus conferred is too brief and uncertain to be practicable. When used as a curative agent the results are said to be promising. Immune serum can be secured from no other animal than man and monkeys. J. D. L.

ETIOLOGY OF CHOREA

Morse, John Lovett, and Floyd, Cleveland: A Study of the Etiology of Chorea. Amer. Jour. Diseases of Children, July, 1916, Vol. XII, p. 61.

An exhaustive study of chorea in twenty-six cases was undertaken with a view to determine the parts which syphilis and bacterial infection play in the etiology of the disease.

It is admitted that some cases of chorea have been benefited by the use of salvarsan, but the good results secured have probably been due to the parasiticidal action of the arsenic.

A study of these cases justifies the conclusion that syphilis seldom if ever plays any active part in the etiology of chorea.

There is much that points to a microorganism as the cause of chorea, but this as yet has not been proven. If caused by a microorganism the source of infection is ordinarily in the tonsils and teeth. Investigations confirm the belief that chorea, rheumatism and endocarditis are intimately associated. J. D. L.

SWIMMER'S CONJUNCTIVITIS

Gradle, Harry S.: Swimmer's Conjunctivitis. Opthalmology, Vol. XII, 1916, p. 652.

The following article is of particular interest at this time of year when swimming may be classed as one of the most popular sports.

The author quotes P. Schultz of Berlin as having reported the first case in 1899, who described the infection as "clinically characteristic, contagious conjunctivitis, very similar in its initial appearance to trachoma, but radically different when judged from the clinical course."

He further quotes Brown as having reported five hundred cases occurring in Philadelphia during the summer of 1914, the source of infection being traced to various baths in a restricted area. The period of incubation is stated to be twelve hours.

Gradle had eighteen cases under observation during the summers of 1914-1915.

The clinical picture is described by the author as follows:

"In the earlier stages of the disease, occasionally unilateral but frequently bilateral within a week.

"Moderate photophobia.

"Small amount of muco-purulent secretion, particularly at night.

"Moderate œdema of the lids.

"Tarsal conjunctiva slightly swollen and roughened. Coarse injection with individual vessels standing out prominently. No distinct hyperplasia of follicles. These symptoms increasing as the transitional folds are approached.

"Conjunctiva of the transitional folds more swollen, with a smoother surface and deeper red color. Injected vessels lose their individuality. On eversion, the conjunctiva presents the rugælike appearance characteristic of the rectal mucosa.

"Bulbar conjunctiva slightly œdematous and swollen. Moderate coarse injection beginning at the transitional folds and decreasing toward the cornea, so that the limbus is surrounded by a zone of normal appearing conjunctiva. Caruncle participates only slightly in the conjunctival infections."

The treatment found most effective was 1 per cent silver nitrate daily and 10 per cent argyrol three times a day. It seemed most effective when dropped "directly in the conjunctival sac; for forcible closure of the lids, spread the caustic into the depths of the transitional folds, the parts most affected."

The author concludes by stating he believes his cases coincide with those reported from Berlin and that they form a definite clinical entity. W. S. M.

ROENTGENOGRAPHIC DIAGNOSIS

Moore, Alexander B., and Carman, R. D.: Roentgenographic Diagnosis of Metastatic Pulmonary Malignancy. Amer. Jour. of Roentgenology, Vol. III, 1916, p. 126.

The roentgenologic appearance of metastatic malignancy is quite typical and consists in the localization of clear-cut circumscribed areas of increased density, varying in size, from the head of a small hat-pin to that of an orange.

Their conclusions bring out the points of interest in their paper:

"1. Pulmonary metastatic malignancy is not an uncommon condition and may occur regardless of the seat of the primary focus.

"2. Pulmonary matastasis bears no relationship to the extent or the duration of the primary focus.

"3. The clinical picture in a majority of these cases is very indefinite, neither the subjective nor the objective manifestations being characteristic of the condition.

"4. Metastatic pulmonary malignancy is a definite roentgenographic entity, appearing in the roentgenogram as clear-cut circumscribed areas of increased density.

"5. In many instances the diagnosis can be established only by the roentgenogram. By routine roentgenographic examination of the thorax many patients suffering from malignancy will be saved from useless and unwarranted surgery." L. W. C.

Publisher's Notes

HAY FEVER AND ITS COMPLEXITIES.

Because of the protean manifestations of hay fever and its irregular appearance, either as the early-summer variety or the so-called autumnal catarrh, it is evident that no single therapeutic agent can eliminate, or even modify, the symptoms in all cases. Each individual sufferer presents problems that pertain peculiarly to himself, and other than the vasomotor relaxation of the upper respiratory tract, which is common to all, there are no uniform underlying pathologic changes.

These cases may be divided into three classes: those in which the neurotic element is the predominating feature; those wherein a general systematic condition, as lithemia, seems to stand out conspicuously, and—much the largest class—those in which the affection is intimately associated with the presence of pollen in the atmosphere.

Undoubtedly the suprarenal substance, in the form of its isolated active principle, Adrenalin, is one of the most reliable agents for the treatment of hay fever. Experienced physicians assert that it successfully controls the symptoms in a large majority of cases. Adrenalin cloride solution and Adrenalin Inhalant are the preparations most commonly used, being sprayed into the nares and pharynx. The former should first be diluted with four to five times its volume of physiologic salt solution. The latter may be administered full strength or diluted with three to four times its volume of olive oil.

A NEW CORPORATION.

Announcement has just been made of the formation of a new corporation, called the Victor Electric Corporation, which has purchased the business of the following firms:

Victor Electric Company, Jackson Boulevard and Robey Street, Chicago, Ill.; 110 East 23rd Street, New York.

Scheidel-Western X-Ray Company, 737 West Van Buren Street, Chicago, Ill.; 110 East 23rd Street, New York.

Macalaster-Wiggin Company, 66 Broadway, Cambridge, Mass.; 154 West Lake Street, Chicago, Ill.; 110 East 23rd Street, New York.

Snook-Roentgen Manufacturing Company, 1210 Race Street, Philadelphia, Pa.; 110 East 23rd Street, New York.

The purpose of the new corporation is to continue the respective business policies of the above mentioned concerns, and by the elimination of waste and the development of cooperative service, be better able to serve more efficiently the interests of the medical profession.

The sales and service organization will be much more comprehensive than heretofore, it being the plan to continue all of the present branch offices and open new ones in all sections of the country so that ultimately no member of the profession, no matter where located, will be more than a few hours distance from a trained man, who can render intelligent and efficient service.

By maintaining a research department to cooperate with the profession in the development of this science, it is expected that more rapid progress can be made than has been heretofore, and a greater cooperation secured with the profession as a whole.

The new corporation announces that it expects to conduct its business in an entirely ethical manner, believing that there is a standard of ethics in business that conforms exactly with our ethics and traditions.

It is also the purpose of the new corporation to make every customer feel that the pleasant relations existing between them and the various firms will be continued. They wish it to be known that repair parts and supplies for the apparatus of the constituent concerns may be obtained at any of the afore-mentioned addresses.

The stabilization of this industry is another great advantage which, with the added economy of production, assures the profession of the greatest values and a conduction of the business along sound financial lines.

The names of those associated with its management, who formerly had charge of the respective merged companies, are men of high calibre and recognized ability and warrant us in wishing the new corporation the best of success.

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